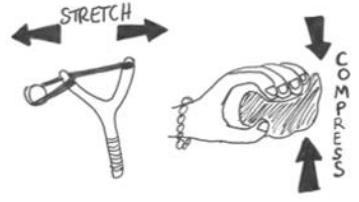
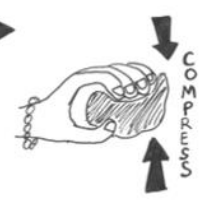
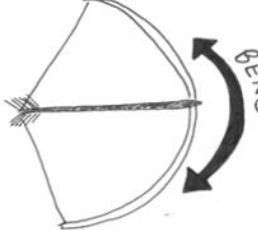


STRETCH  **COMPRESSION** 

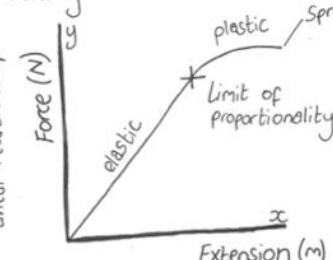
BEND 

Extension - how far you can stretch something

Plastic - doesn't bounce back

Elastic - bounces back

HOOKE'S LAW Linear relationship



plastic - Spring breaks

Limit of proportionality

Spring constant (N/m) matches gradient = y/x

\therefore force/extension = N/m

2. Stretching materials

Force (N) vs Extension (m)

eg. rubber - failure!

stiff

other non-linear stress-strain graphs

ductile

brittle

sneaps

Energy transferred = $0.5 \times \text{Spring constant} \times \text{extension}^2$

$J = 0.5 \times \text{N/m} \times \text{m}^2$

Deform = stores energy

Elastic = transfers energy

crash - absorb energy

bumper

bounce back

gravity = mass \times gravitational field strength

force (of attracted object)

$(N) = (kg) \times (N/kg)$

weight = mass \times gravitational field strength

$(N) = (kg) \times (N/kg)$

look - it's the same!!

\therefore weight = gravity force

60kg ← MASS → 60kg

96N ← WEIGHT → 600N approx.

mass 7×10^{22} kg

$g = 9.8 \text{ N/kg}$

\therefore gravity force on moon = $7 \times 10^{22} \times 9.8$

force = $6.8 \times 10^{23} \text{ N}$

ROUND TO 10

MOON $g = 1.6 \text{ N/kg}$

EARTH $g = 9.8 \text{ N/kg}$

3. Gravity

$g = \text{gravitational field strength} = \text{gravity constant} = \text{acceleration due to gravity}$

gravitational potential energy (J) = mass \times height \times g-f

$(J) = (kg) \times (m) \times (N/kg)$

Basically, the greater the height, the greater the g.p.e. stored

more gravitational potential energy

lower = less g.p.e.

resultant force = mass \times acceleration due to gravity

$(N) = (kg) \times (m/s^2)$

look - it's the same again!

10N

600N

$1 \times 10^{11} \text{ N}$

EARTH acceleration = 9.8 m/s^2

1. Springs

P2.3 Forces in Action

OCR Gateway GCSE Physics

Clockwise moment

9 12 3 6

SMALL FORCE MULTIPLIER

SHORT HANDLE HARD TO TURN

NO HANDLE NO FORCE MULTIPLIER VERY HARD TO TURN

LONG HANDLE

EASY TO TURN

GREATER FORCE MULTIPLIER

anti-clockwise moment

9 12 3 6

Moment of force = force \times distance

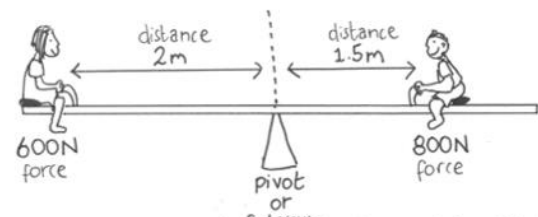
$(Nm) = (N) \times (m)$

due is in the units!

4. Turning forces

Balanced

The Principle of Moments



600N force

distance 2m

distance 1.5m

800N force

pivot or fulcrum

$600 \text{ N} \times 2 \text{ m} = 1200 \text{ Nm}$

$800 \text{ N} \times 1.5 \text{ m} = 1200 \text{ Nm}$

LEVER - force multiplier

LOAD

EFFORT

Archimedes 300BC

effort = force you put on lever

mechanical advantage = $\frac{\text{LOAD}}{\text{EFFORT}}$

Load \times distance from load to pivot = distance from pivot to effort \times effort

5. Simple machines

Gears

Ratio 1:2 (number of teeth)

Ratio 1:4

Smaller force multiplier more effort to go fast

Bigger force multiplier less effort to go fast

Pulleys

LOAD

EFFORT

Ramps - inclined plane reduces effort to gain height

Screwdrivers - rotating levers

fatter handle turns easier

6. Hydraulics

water i.e. hydrate

- using liquid to move a piston

Small force

Large force

pressure of liquid remains constant

surface area of piston

Pneumatics

air i.e. pneumonia (lung infection - lungs breathe oxygen from air)

- using air (gas) to move a piston

force = pressure \times area

$(N) = (Pa) \times (m^2)$

\therefore force multiplier

Equations

- moment (Nm) = force (N) \times distance (m)
- energy transferred (J) = $0.5 \times \text{Spring constant (N/m)} \times (\text{extension (m)})^2$
- gravity force (N) = mass (kg) \times gravitational field strength (N/kg)
- weight (N) = mass (kg) \times gravitational field strength (N/kg)
- gravitational potential energy (J) = mass (kg) \times height (m) \times gravitational field strength (N/kg)
- force exerted by spring (N) = Spring constant (N/m) \times extension (m)